

6 December 1979

STAT MEMORANDUM FOR: [REDACTED]
Chief, OC [REDACTED]
STAT FROM : [REDACTED]
Chief, Research Branch/PSS-OMS
SUBJECT : Evaluation of Cable Secretariat Proposal
to Alter Cable Print Format from 6 to
8 Lines per Inch. (UNCLASSIFIED)

1. The purpose of this memorandum is to respond to your request for our evaluation of the impact of reducing the format of all electronic cables from the current 6 lines per inch (LPI) down to a smaller 8-LPI printed format.

2. We have reviewed the results from your informal questionnaire circulated to offices currently receiving cables. We have reviewed the open literature on the subject of print size and legibility. Further, we have discussed, and find ourselves in substantial agreement on the likely outcome of your proposed change in print format. Accordingly, we offer the following observations and opinions in response to your request.

3. First, it is highly appropriate to forecast a scenario which often occurs in circumstances similar to those surrounding your proposed cable format change. As is usually the case when a well-established standard is substantially altered, there will almost certainly be some initial complaints surrounding the change. Then, following a period of time during which employees become adjusted to the new format and during which some possible shifts in employee job assignments catalyzed by the change may occur, the frequency and intensity of the complaints will gradually level off and eventually subside to an essentially zero level. This sequence of status-quo → change → unrest → adjustment → status-quo is entirely normal and should be expected following alteration of a long-held standard. The important matter, however, is not whether the change will

ATTACHMENT

SUBJECT : Evaluation of Cable Secretariat Proposal
to Alter Cable Print Format from 6 to 8
Lines per Inch. (UNCLASSIFIED)

draw criticism, but rather, what will be the impact of this change in terms of information availability to those members of the community utilizing cables as a necessary adjunct to their respective assignments? Further, can the necessary adjustments to the change take place in a timely fashion?

4. We believe that the answers to these issues are:

- (a) a substantial net gain can result from the proposed change to an 8-LPI cable format and that,
- (b) so long as a few essential caveats are observed and recognized, the adjustment by the community to the new format will take place in an orderly and timely fashion despite some initial criticism which may appear at times to be quite impassioned.

5. The following observations are offered in support of our position outlined in paragraph 4 above. In the present 6-LPI format, slightly more than 30% of all printed cables can fit on a single page (i.e., slightly fewer than 70% require the manual collation of two or more pages in order to include the entire cable message). With the proposed 8-LPI format, slightly more than 95% of all cables will fit on a single page. This one fact will represent an enormous time, manpower, and materials savings to the U.S. Government. Further, while the shift to 8-LPI does require the use of smaller print characters and a slight loss in background space between adjacent lines, the effect on overall legibility while measureable, is small. The Systems Analysis Staff of the Office of Central Reference estimates that 75% of all cable traffic is "scanned" for key words or phrases while only 25% is read for detail. These figures may vary considerably across different offices, but they are probably quite accurate when the entire population of cable users is considered. If this is true, the 8-LPI format will probably result in a reduction of time necessary for scanning cables. At the very least, it will almost surely not impact negatively on scanning functions. For the minority of cable

SUBJECT : Evaluation of Cable Secretariat Proposal
to Alter Cable Print Format from 6 to 8
Lines per Inch. (UNCLASSIFIED)

recipients who must read for detail, there may be an initial but minimal negative impact until adjustments take place. It may for example, take slightly more initial effort (resulting, in some cases, in more eyestrain than was incurred in the 6-LPI format) to extract the necessary information. This negative impact can be expected to decrease over time, as users become increasingly familiar with the new appearance of the cables and as personnel shifts take place. In the latter circumstance, employees who seem unable to adjust to the somewhat smaller print of the 8-LPI format or who seem particularly susceptible to headaches or eyestrain induced or aggravated by the smaller 8-LPI format, will probably find it necessary to accept job assignments which minimize or even eliminate the need to read the new cables. Some problems notwithstanding, we feel that the shift from 6-LPI to 8-LPI will cause very few serious difficulties and will, for the vast majority of cable recipients, result in substantially increased efficiency and dramatic cost savings.

6. Several caveats should be observed, however, in the administration of the proposed change. First, the printers used to produce the 8-LPI cables should be continuously and closely monitored to ensure clean typeface on the hammers (in the case of impact printers) and frequently changed ribbons so that maximum edge definition and contrast between the printing and the background paper will be realized. Second, the use of a flat-finish ink instead of a glossy ink would reduce glare. Third, if it were possible to reduce slightly the space between letters within words, there would be a noticeable increase in overall legibility of the cables as the spacing between the lines would then appear greater. Last, the quality of paper on which the cables are printed should be carefully controlled so that ink bleed-through is precluded and maximum opacity is maintained.

STAT

ANNOTATED BIBLIOGRAPHY OF
STUDIES RELATING TO LEGIBILITY
OF PRINTED MATTER

Legibility of letters, digits, and other symbols

CROSLAND, H.H., & JOHNSON, GEORGIA. The range of apprehension as affected by inter-letter hair-spacing and by characteristics of individual letters. Journal of Applied Psychology, 1928, 12, 82-124.

Investigates the effects of 1/2 point inter-letter spacing and of position in the group and characteristic form on legibility of letters. The inter-letter spacing did not appreciably affect legibility; but legibility of individual letters in group progressed from left to right. Letters with serifs were significantly more legible than sans-serif letters.

OVINK, G.W. Legibility, atmosphere-value and forms of printing types. Leiden: A.W. Sitjthoff's Uitgeversmaatschappij N.V., 1938.

Studies, using a short exposure technique, the legibility of lower case letters of uniform stroke and of upper and lower case display types. Detailed results are given for each character and suggestions for maintaining or improving legibility of single letters and numbers. A survey of studies on the legibility of print is included in the book.

ROTHLEIN, BARBARA E. The relative legibility of different faces of printing types. American Journal of Psychology, 1912, 23, 1-36.

Investigates by the distance method the legibility of isolated and grouped alphabet letters in 26 different typefaces. Certain typefaces were found to be more legible than others. This was also true for the letters. Factors that influenced legibility were assigned to letter form, size, heaviness of typeface, width of white margin surrounding letter, position of letter in letter group, and shape and size of adjacent letters.

SOAR, R. S. Height-width proportion and stroke width in numerical visibility. Journal of Applied Psychology, 1955, 39, 43-46.

Determines the effect of different combinations of height and width, with area constant, on the visibility of numerals by a short exposure method. The most visible combinations for all numerals occurred with a height-width ratio of 10:7.5 and a stroke width to height ratio of 1:10.

TINKER, M. A. The relative legibility of the letters, the digits, and of certain mathematical signs. Journal of Applied Psychology, 1928, 1, 472-496.

Uses a short exposure technique to determine the relative legibility of the alphabet letter, the digits, and certain mathematical signs. It was concluded that the following factors influence the legibility of isolated characters: size, simplicity or complexity of outline, stroke width, heaviness of typeface, shading and hairlines, area of white space included within the outline of a symbol, and emphasis or lack of emphasis on differentiating parts. This last seemed most important.

Kinds of type or type form

BURT, C. A Psychological study of typography.
Cambridge: Cambridge University Press, 1959.

Studies different styles of printing by tests of accuracy and speed of reading, observation of eye movements, blinking, and other symptoms of eyestrain. Since different characteristics of typography interact, measurement of one variable at a time may be misleading. Old Style Antique appeared most appropriate for children under 12; and Imprint, Plantin, or Times New Roman for children over 12. With adults, wide variation of typographical factors seemed permissible without greatly affecting reading efficiency. Ten or eleven point type with two point leading in line widths of 20 to 23 ems appeared most satisfactory. Somewhat wider lines and narrower margins seemed preferable for technical publications, and slightly narrower lines and larger sizes of type for literary works.

LUCKIESH, M., & MOSS, F.K. The visibility of various type faces. Journal of the Franklin Institute, 1937, 223, 77-82.

Studies the relative visibility of 20 type faces and the effect of changes in light intensity on visibility. Garamond Bold was the most visible and Caslon Light Italic the least visible. It was concluded that increases in illumination could compensate for deficiencies in visibility for type sizes between 6 and 12 point, and for differences between various type faces.

LUCKIESH, M., & MOSS, F.K. Boldness is a factor in type design and typography. Journal of Applied Psychology, 1940, 23, 170-183.

Obtains visibility, blink rate, and speed of reading scores for 10 point Memphis Light, Medium, Bold, and Extra Bold types. The visibility and frequency of blinking scores indicated that Memphis Medium was the optimum degree of boldness. Speed of reading results were equivocal.

PATERSON, D.G., & TINKER, M.A. Studies of typographical factors influencing speed of reading: X. Style of type face. Journal of Applied Psychology, 1932, 16, 605-613.

Measures the relative legibility of the following ten typefaces: Scotch Roman, Garamond, Antique, Bodoni, Old Style, Caslon Old Style, Kabel Light, Cheltenham, American Typewriter, and Cloister Black. The text in American Typewriter and Cloister Black significantly retarded speed of reading, but the other type faces in common use were equally legible.

POULTON, E.C. Effects of printing types and formats on the comprehension of scientific journals. Cambridge: Cambridge University Press, 1959.

Reports an experiment. A test of the relative comprehensibility in scientific papers for the four different styles of printing used revealed one arrangement (11 point type with 2 point leading in a 30 pica line width) superior to the others.

POULTON, E.C. Letter differentiation and rate of comprehension in reading. Journal of Applied Psychology, 1965, 49, 358-362.

Reports experiment where subjects read passages in one of seven typefaces, four without serifs and three with serifs. Of those without serifs, Gill Medium was read significantly faster. There were no significant differences in rate between the serif typefaces, nor between the serif and serifless faces.

PRINCE, J.H. Relationships of reading types to uncorrectable visual acuity. American Journal of Optometry and Archives of American Academy of Optometry, 1957, 34, 581-595.

Presents evidence concerning the effect of scientifically planned inter-letter spacing on visibility of print by people with subnormal vision. With the planned spacing, print that is ordinarily visible only to people with emmetropia (normal vision) was made visible to subjects with a certain degree of uncorrected low visual acuity.

PYKE, R.L. Report on the legibility of print. London: H.M. Stationery Office, September 1926.

Investigates the relative legibility of eight type faces. The least legible types (Modern Condensed No. 39 and Caslon Modern Series No. 23). Pyke questions the validity of this difference. He states that there must be marked differences in typefaces to produce significant differences in legibility in ordinary reading.

RADOJEVIC, S. Die Erkennbarkeit von Antiqua und Frakturbuchstaben im indirecten Sehen. Archiv fur Augenheilkunde, 1921, 88, 192-197.

Reports a study on the relative legibility of Roman and German type. The results of this and of other studies showed a slight advantage for the German type (practically no difference) for lower case letters but an advantage for capitals for the Roman type. More recent studies tend to give an advantage to the Roman type for both lower case and for capitals.

SOAR, R.S. Readability of typography in psychological journals. Journal of Applied Psychology, 1951, 35, 64-67.

Examines eighteen journals for conformity with optimal printing practices. Certain non-optimal practices were found to be widespread or even had increased. Little evidence was found that available research findings were being applied although this would have resulted in more legible printing.

STARCH, D. Principles of advertising. Chapter XXV. Layout and Typography. Chicago: A.W. Shaw Company, 1923, Pp. 657-669.

Uses speed of reading to compare the effects of type styles, line widths, and variation of background on legibility of print. Roman type was read more rapidly than italic, and text in lower case was read 10 per cent faster than in all capitals. Material set in 2 3/4 inch lines was read more rapidly than that in 1 1/2 or 5 inch lines. Black print on a white background was read 42 per cent faster than white print on a dark grey background.

TINKER, M.A. The influence of form of type on the perception of words. Journal of Applied Psychology, 1932, 16, 167-174.

Uses the distance method to compare the perceptibility of words and letters in lower case and in all capital printing. The results indicated that word form is more important in reading text in lower case print than in reading text printed in capitals.

TINKER, MA., & PATERSON, D.G. Influence of type form on speed of reading. Journal of Applied Psychology, 1928, 12, 359-368.

Obtains the speeds of reading lower case print versus all capitals and italics. Lower case print was read 13.4 percent faster than all capitals and 2.8 per cent faster than italics.

TINKER, M.A. & PATERSON, D.G. Influence of type form on eye movements. Journal of Experimental Psychology, 1939, 25, 528-531.

Examines the specific patterns responsible for the disclosed 13.4 per cent retardation in rate of reading all capital text in comparison with text in lower case through recording eye movements photographically. The slower reading of all capitals was due mainly to an increase in the number of fixations, and an increase in total perception time.

TINKER, M.A. & PATERSON, D.G. Reader preferences and typography. Journal of Applied Psychology, 1942, 26, 38-40.

Compares ordinary lower case versus boldface lower case, and lower case versus all capital printing to find the extent of agreement between judged legibility and judged pleasingness. Readers place high esthetic value on the printing arrangements which appear most legible. Consequently, there was close agreement between judged legibility and judged pleasingness.

TINKER, M.A. & PATERSON, D.G. Readability of mixed type forms. Journal of Applied Psychology, 1946, 30, 631-637.

Obtains speed of reading scores for two medley typographical arrangements versus straightforward lower case type. The medley arrangements retarded reading speed 8.35 and 11.39 per cent. Judged legibility agreed with the readability measurements but judged pleasingness disagreed with both judged legibility and speed of reading scores.

TINKER, M.A. Prolonged reading tasks in visual research. Journal of Applied Psychology, 1955, 39, 444-446.

Demonstrates the usefulness of longer periods of reading in investigating the effects of typographical variations on speed of perception in reading. With periods of 10 minutes or more, italic print significantly retarded speed of reading in comparison with Roman print. All capital print retarded reading rate significantly regardless of length of work period between four and sixteen minutes.

WEBSTER, HELEN A., & TINKER, M.A. The influence of typeface on the legibility of print. Journal of Applied Psychology, 1935, 19, 43-52.

Determines the relative legibility of the following typefaces by the distance method: Scotch Roman, American Typewriter, Cheltenham, Antique, Old Style, Caslon Old Style, Garamond, Bodoni, Kabel Lite, and Cloister Black. American Typewriter was the most legible typeface and Cloister Black the least legible. The results are considerably different from those obtained by speed of reading measurements and suggest that certain factors which increase perceptibility of words at a distance reduce speed of reading.

Size of type, line width, and leading

ALDERMAN, E. The effect of size of type on speed of reading and the determination of various factors that may influence the results. The Pittsburgh Schools, 1938, 13, (11 & 12), 33-63.

Uses speed of reading to study legibility of sizes of type and to investigate the role of mental age, intelligence, etc., in reading performance. For all groups and all variables, smaller type sizes were read faster than larger. It was concluded that the printing of primary grade textbooks in large type sizes is unwarranted.

GILLILAND, A.R. The effect on reading of changes in the size of type. Elementary School Journal, 1923, 24, 138-146.

Studies the effect of changes in type sizes on reading. The reading of adults was not much affected by changes in type size between 6 and 36 point. Individual variations in the effects of type size were considerable. It was concluded that type size is not as important a factor in the reading of children as has sometimes been supposed. The photographic reduction and enlargement of type sizes did not duplicate printing conditions.

GLANVILLE, A.D., KREEZER, G.L., & DALLENBACH, K.M. The effect of type size on accuracy of apprehension and speed of localizing words. American Journal of Psychology, 1946, 59, 220-235.

Studies accuracy of apprehension and speed of locating dictionary words printed in 6 to 12 point type. Printing vocabulary words in 12 point boldface is better than 6 point boldface since the former can be more quickly and easily located. Both adults and children preferred the larger type size.

PATERSON, D.G., & TINKER, M.A. Studies of typographical factors influencing speed of reading: II. Size of type. Journal of Applied Psychology, 1929, 13, 120-130.

Obtains speed of reading for 6, 8, 10, 12, and 14 point type in a 19 pica line width. Text in the 6, 8, 12, and 14 point type was read significantly slower than text in the 10 point type.

PATERSON, D.G., & TINKER, M.A. Influence of size of type on eye movements. Journal of Applied Psychology, 1942, 26, 227-230.

Compares oculomotor patterns for reading 6 point and 14 point type versus patterns for reading 10 point type. Text in 10 point type was read more efficiently than text in either 6 or 14 point. Reduced visibility apparently caused the lessened efficiency in reading the 6 point type. For the 14 point type, the loss in efficiency was primarily due to the increased amount of printing area that had to be covered by the eyes in reading a given amount of text.

TINKER, M.A., & PATERSON, D.G. Studies of typographical factors influencing speed of reading: IX. Reduction of size of newspaper print. Journal of Applied Psychology, 1932, 16, 525-531.

Compares the legibility of 7 point Ionic lino-type and photographic reproductions of it at 80, 50, and 30 per cent of the original size. Reductions to 80 per cent did not significantly lessen speed of reading, and reduction to 50 per cent did not reduce reading rate enough to make it impractical to use. Reduction to 30 per cent yielded print close to the lower limits of perceptibility.

Width of line

DEARBORN, W.F. The psychology of reading: Chapter XII. The length of text-lines and motor habits. Archives of Philosophy, Psychology and Scientific Methods, 1906, 4, 8; 13-14; 99-115.

Determines the effect of variation in line width on eye movements in reading. It took more fixations to read the same amount of material in short lines, the attention span was smaller and pause duration was less. Line width appeared to be a major determinant of the distribution of time given to parts of a sentence. It was concluded that regular, uniform motor habits were more readily formed in reading short lines, and the field of attention could be expanded more frequently and easily.

LUCKIESH, M., & MOSS, F.K. The effect of line length on readability. Journal of Applied Psychology, 1941, 25, 67-75.

Obtains blink rate, eye movements, and speed of reading while reading materials set in 10 point Textype in 13, 17, 21, 25, and 29 pica line widths. The blink rate scores indicated that readability improved from 13 to 21 picas. The eye movements and speed of reading failed to show marked differences.

PATERSON, D.G., & TINKER, M.A. Influence of line width on eye movements. Journal of Experimental Psychology, 1940, 27, 572-577.

Compares oculomotor patterns employed in reading a very short 9 pica line and a very long 43 pica line to those for an optimal 19 pica line. The very short and very long line produced less efficient reading. Apparently the readers were unable to make maximum use of horizontal perceptual cues in reading the short lines. In the long lines there was difficulty in locating the beginning of each new line at the end of the back sweep.

PATERSON, D.G., & TINKER, M.A. Influence of line width on eye movements for six point type. Journal of Educational Psychology, 1942, 33, 552-555.

Reports an experiment in which eye movements were photographed while reading text in 6 point type in 5, 36, and 13 pica line widths. The oculomotor patterns revealed less efficiency in reading the very short and very long lines than for the 13 pica line. The conclusion is that difficulty in reading the short lines was due to the inability to make maximum use of horizontal perceptual cues, and that the difficulty in reading the long lines was due to inability of the eyes to locate accurately the beginning of successive lines of print.

TINKER, M.A., & PATERSON, D.G. Studies of typographical factors influencing speed of reading: III. Length of line. Journal of Applied Psychology, 1929, 13, 205-219.

Investigates speed of reading 10 point type in line widths (lengths) varying from 59 to 186 millimeters. An 80-millimeter line was read fastest.

Leading

BENTLEY, M. Leading and legibility. Psychological Monographs, 1921, 30, 48-61.

Measures the influence of 10 different amounts of leading upon legibility of three type sizes read at various distances from the eyes. Rate and ease of reading depended to some degree upon leading. Material set solid (no leading) was read relatively slowly. Speed of reading increased with each addition of leading up to 7 point and then declined rapidly.

LUCKIESH, M., & MOSS, F.K. Effects of leading on readability. Journal of Applied Psychology, 1938, 22, 140-160.

Obtains legibility of 10 point Linotype Texttype with 0, 1, 2, 3, and 6 point leading by tests of reading rate and blink frequency. The speed of reading criteria failed to show any significant differences with variation in leading. But the blink techniques suggested that the practical optimum in legibility was with 3 point leading.

PATERSON, D.G. & TINKER, M.A. Studies of typographical factors influencing speed of reading: VIII. Space between lines or leading. Journal of Applied Psychology, 1932, 16, 388-397.

Obtains speed of reading 10 point type in a 19 pica line width with 0, 1, 2, and 4 point leading. In comparison with set solid, 1 point leading did not improve speed of reading. But text with 2 point leading was read 7.5 per cent faster, and with 4 point leading 5.0 per cent faster than for set solid text.

Coordination: type, size, line width, and leading

GREEN, E.B. The legibility of typewritten materials.
Journal of Applied Psychology, 1933, 17, 713-728.

Reports an experiment in which measurements of speed of reading 7, 10, 12, and 14 point typewriter type with variations in line width and leading were made. No differences in speed and accuracy of reading texts in the various type sizes were found. Leaded samples were read 3.3 per cent faster than the material set solid. The 21 pica line was read 1.1 per cent faster than the 41 pica line.

LUCKIESH, M., & MOSS, F.K. The extent of the perceptual span in reading. Journal of General Psychology, 1941, 25, 267-272.

Studies the effects of varying type size and line width on the perceptual span in reading. The number of characters per fixation decreased from 8.50 to 7.84 as type size was increased from 4 to 10 points. The span increased from 8.14 to 9.31 characters as the line width was increased from 13 to 29 picas. It was concluded that the number of characters recognized in a typical fixation seemed to be largely independent of type size and line width.

PATERSON, D.G., & TINKER, M.A. How to make type readable. New York: Harper and Row, 1940.

Reports the results of 12 years of research by the authors on legibility of print as measured by a speed of reading technique. The legibility factors investigated include: type forms - type faces, italics versus lower case, all capitals versus lower case, boldface versus ordinary lower case; size of type, width of line, and leading and the relationship between two or more of these factors; spatial arrangement of the printed page, including size of full page, size of printed page, margins, single versus double column composition; intercolumnar space and rules, and paragraph arrangement; black versus white print; color of print and background and color combinations; printing surfaces; and optimal versus non-optimal printing arrangements for three type sizes. Specifications for a printed page of optimal legibility were given.

PATERSON, D.G. & TINKER, M.A. Eye movements in reading type sizes in optimal line widths. Journal of Educational Psychology, 1943, 34, 547-551.

Records eye movements while reading text in 6, 8, and 11 point type set in optimal line widths. With 8 versus 11 point type there were significant increases in fixation frequency, pause duration, and perception time, and a decrease in words per fixation for the 8 point type. Reading the text in 6 point type produced significant increases in pause duration and perception time over that for the 11 point type, an optimum type size.

PATERSON, D.G., & TINKER, M.A. Eye movements in reading optimal and non-optimal typography. Journal of Experimental Psychology, 1944, 34 80-83.

Compares eye movements in reading optimally arranged 10 point type with eye movements for reading text in non-optimally arranged 6 point type. Reading the non-optimal arrangement resulted in highly significant differences in all eye-movement measures except pause duration. When several undesirable typographical factors are combined, they operate together to produce exceedingly inefficient oculomotor patterns.

PATERSON, D.G., & TINKER, M.A. The effect of typography upon the perceptual span in reading. American Journal of Psychology, 1947, 60, 388-396.

Reports eight studies completed to determine the effect of various typographical factors on the perceptual span in reading. Eye movement patterns were compared while reading text varying in type form, line width, and other factors. It was concluded that variation in typographical factors influence the size of the perceptual span.

TINKER, M.A., & PATERSON, D.G. Studies of typographical factors influencing speed of reading: V. Simultaneous variation of type size and line length. Journal of Applied Psychology, 1931, 15, 72-78.

Investigates the speed of reading text in Scotch Roman type in various line widths and type sizes. A line printing arrangement was employed. The 8 and 10 point types were read equally fast and the larger type sizes were nearly as good. But 6 point type in its short line width reduced reading efficiency significantly.

TINKER, M.A., & PATERSON, D.G. Speed of reading nine point type in relation to line width and leading. Journal of Applied Psychology, 1949, 33, 81-82.

Measures the speed of reading 9 point Scotch Roman type set with 0, 1, 2, and 4 point leading in 8, 14, 18, 30, and 40 pica line widths. The optimal arrangements fell within a 14 to 30 pica line width with 1 to 4 point leading.

Summaries and Surveys

BOWERMAN, G.W. et al. Report of the committee appointed to select the best faces of type and modes of display for government printing. London: H.M. Stationery Office. 1922.

Deals with the best typefaces to be used in government printing as revealed in various discussions and experiments.

BURTT, H.E. Typography and readability. Elementary English, 1949, 26, 212-221.

Presents a critical survey of legibility of print studies with special emphasis upon the University of Minnesota investigations (Paterson and Tinker experiments).

GAGE, H.L. Research in readability: I. The program for research. Linotype News, 1937, 16, 2.

Suggests research on the legibility of print.

GAGE, H.L. Research in readability: II. Effects of Leading. Linotype News, 1938, 16, 2.

Surveys some of the factors involved in the effects of leading on the legibility of print.

HUEY, E.B. The psychology and pedagogy of reading. New York: The Macmillan Company, 1908.

Contains a chapter that surveys and evaluates the legibility of print as reported in studies prior to 1908.

LUCKIESH, M., & MOSS, F.K. The science of seeing. Chapter XII. Reading as a visual task (Typography). New York: D. Van Nostrand Company, 1937. Pp. 455-467.

Contains a chapter in which early studies on the legibility of print are discussed and evaluated.

LUCKIESH, M., & MOSS, F.K. Reading as a visual task. New York: D. Van Nostrand Company, 1942.

Contains an extensive report of studies completed by the authors and colleagues on various factors affecting the legibility of print and visual fatigue.

MERGENTHALER LINOTYPE COMPANY. The legibility of print. Brooklyn: Author, 1935.

Presents a small treatise on legibility of print from the viewpoint of the printer.

PYKE, R.L. Report on the legibility of print. London: H.M. Stationery Office, 1926.

Contains an excellent summary of legibility studies published prior to 1926.

TINKER, M.A. Legibility and eye movements in reading. Psychological Bulletin, 1927, 24, 621-639.

Surveys the studies published prior to 1927 on the legibility of print.

TINKER, M.A. Physiological psychology of reading. Psychological Bulletin, 1931, 28, 81-97.

Reviews certain studies that have a bearing on the legibility of print.

TINKER, M.A. Experimental study of reading. Psychological Bulletin, 1934, 31, 98-110.

Presents a critical review of experiments on eye movements, perception, etc., in the field of reading. Some of the studies have a bearing on the legibility of print.

TINKER, M.A. Eye movements, perception, and legibility in reading. Psychological Bulletin, 1936, 33, 279-290.

Gives a critical review of reports on the legibility of print and certain other related materials.

TINKER, M.A. Recent studies of eye movements in reading. Psychological Bulletin, 1958, 54, 215-231.

Presents a critical review of studies on eye movements in reading, including eye movements as related to legibility of print.

TINKER, M.A. Legibility of print. Ames, Iowa: Iowa State University Press, 1963.

Summarizes in detail investigations on the legibility of print published prior to 1960.

TRAXLER, A.E. Ten years of research in reading. New York: Educational Records Bureau, 1941.

Presents a summary of reading investigations with a section on legibility or hygiene of reading.

TRAXLER, A.E., & TOWNSEND, AGATHA. Another five years of research in reading. New York: Educational Records Bureau, 1946.

Summarizes reading investigations, including a section on legibility or hygiene of reading.

TRAXLER, A.E., & TOWNSEND, AGATHA. Eight more years or research in reading. New York: Educational Records Bureau, 1955.

Summarizes reading investigations including a section on legibility or hygiene of reading.

TRAXLER, A.E., & JUNGBLUT, ANN. Research in reading during another four years. New York: Educational Records Bureau, 1960.

Contains a summary of reading investigations with a section on the legibility of print.

VERNON, M.D. The experiment study of reading. Cambridge: Cambridge University Press, 1931.

Presents a systematic treatise on reading, including a section on the legibility of print.

ZACHRISSON, B. Studies in the readability of printed text with special reference to type design and type size: survey and some contributions. Stockholm: The Graphic Institute, 1957.

Reviews studies on the legibility of printed material.

ROUTING AND RECORD SHEET

DD/A REGISTRY
 FILE: *Commo*

SUBJECT: (Optional)

FROM:

Deputy Director for Operations

EXTENSION

NO.

DATE

26 December 1979

TO: (Officer designation, room number, and building)

DATE

OFFICER'S INITIALS

COMMENTS (Number each comment to show from whom to whom. Draw a line across column after each comment.)

1. Deputy Director for Administration

2.

3x-4

12/27

3.

4.

DDA

5.

6.

D/ae

7.

STAT

8.

9.

10.

11.

12.

13.

14.

15.

Discussed is/om comabon

1-4. don:
I think we need to stand firm on our plan to evaluate the new format for 90 days. Johns reaction is consistent with Ray prediction. We need to keep in mind that - if the 8 lines per inch in the new format is unacceptable - we will have to review our plans for APARS. The full value of APARS can only be realized in an 8 lines per inch format.

Slammy
12/27